Citizen Science and Biodiversity Monitoring in Tribal Communities

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A landmark 2023 study in Communications Earth & Environment, examining Global Biodiversity Information Facility data from 2000–2021, found that participatory monitoring has driven a growing dominance within protected area biodiversity data — and that community-monitored data covers different geographic and taxonomic areas than professional monitoring, suggesting genuine complementarity rather than duplication.

The 2024 Nature Sustainability study on the Kunming-Montreal Global Biodiversity Framework found that of 365 GBF indicators, 110 (30%) can directly involve Indigenous Peoples, local communities, and citizen scientists in community-based monitoring, while a further 185 (51%) could benefit from community involvement in data collection. The policy significance: community biodiversity monitoring is not a marginal activity. It is central to how the global framework for reversing biodiversity loss will be measured.

For India specifically, ATREE's research in the Eastern Ghats — directly relevant to Odisha's forest contexts — has documented how community perceptions of landscape

change can be used to understand satellite-based analysis and identify the fine-grained dynamics that remote sensing alone cannot capture. In a published study, community members' observations of forest change corresponded closely with satellite-derived data in some areas and diverged meaningfully in others — the divergences pointing to specific local dynamics (selective tree removal, agricultural encroachment at forest margins, fire management) that the satellite had missed. The combination produced better science than either approach alone.

The locally-based monitoring literature (PMC 2021) is explicit about the motivational dimension: for communities whose livelihoods depend on natural resources, monitoring those resources addresses critical collective needs. Engagement in the resource management process is central to communities' lives. Monitoring that serves community purposes — tracking NTFP availability, identifying water source health, documenting wildlife — maintains participation in ways that data collection for external purposes does not.

The Two Functions of Community Monitoring: Conservation and Legal Rights

This dual function is the most important design insight for Odisha's context, and it distinguishes community monitoring here from generic citizen science approaches.

The conservation function is straightforward: communities that monitor their forests know their condition, identify threats early, and have the information needed to manage them adaptively. A CFMRC that conducts seasonal resource walks and records observations — which species are declining, which areas are regenerating, where illegal felling has occurred — has both the motivation to protect (because they can see the consequences of degradation) and the information to act effectively.

The legal rights function is equally important in Odisha's specific context. CFR titles can be challenged. Mining projects can claim that communities do not actively manage or use the areas they are asserting rights over. Development projects can

contest community boundaries. A CFMRC with five years of systematic monitoring records — species inventories, patrol logs, resource maps, photographic documentation — has evidentiary material that cannot easily be dismissed. The monitoring record is both conservation tool and legal protection.

This dual function should be explicit in how community monitoring is framed with communities: "We are documenting our forest so that we can manage it better AND so that no one can take it from us without documentation showing that this is our managed, our known, our used landscape."

Designing a Community Monitoring Programme: Five Components

Component 1: Community entry and knowledge mapping

Before designing any monitoring protocol, spend time understanding what communities already observe and record — informally, in oral tradition, through the seasonal agricultural and forest use calendar. This serves two purposes: it avoids duplicating what communities already do, and it identifies the most knowledgeable observers who should anchor the monitoring programme.

Questions to explore in community conversations:

- Which species are most important to this community for food, medicine, livelihoods, or cultural reasons?
- Where are the areas of greatest ecological significance — sacred groves, important water sources, wildlife corridors, NTFP-rich patches?
- What ecological changes have community members noticed in the last 5–10 years? What has disappeared or declined? What has returned or increased?
- Who in the community knows the forest best? (These are your anchor monitors — not necessarily the most educated, but the most ecologically literate.)

This mapping conversation produces both the community's priorities for monitoring and the identification of core community monitors.

Component 2: Protocol design — what to monitor and how

The monitoring protocol must be simple enough for community members without scientific training to apply consistently, specific enough to produce useful data, and directly relevant to the community's own priorities and the rights documentation function.

A practical monitoring protocol for tribal forest communities in Odisha:

Seasonal transect walks (twice per year — pre-monsoon and post-monsoon):

- Fixed transect routes (GPS-marked boundaries or well-known landmarks) walked by a group of 5–8 monitors including women and younger community members
- Simple tally of: evidence of illegal felling (fresh stumps, drag marks), presence of key species (species list developed with community), water body condition (flowing/stagnant/dry), regeneration density in designated areas
- Photographic documentation using a shared community smartphone at designated observation points
- Walk produces a 2–3 page monitoring record stored in the gram sabha register

Monthly patrol logs:

- Existing patrol system (thengapalli or equivalent) records, in addition to security incidents, any ecological observations: wildlife sightings, fire evidence, unusual plant die-off, stream condition changes
- A simple form — date, patrol route, observations, patroller name — takes five minutes to complete per patrol and produces a longitudinal record of ecological change

Annual species inventory:

- Once per year, a more comprehensive one-day walk with all community monitors documenting presence/absence of key species (a list of 20–30 species chosen by the community for their significance)
- The inventory is compared year-on-year to document trends

NTFP productivity tracking:

- Records of what was collected, from which area, in which season — maintained by the CFMRC as part of the aggregation process (see CFR to Livelihood Practice Note)
- Declining productivity in a previously productive area is an ecological signal that management intervention may be needed

Component 3: Training for community monitors

Training takes two days for a group of 8–12 community monitors. It is conducted in the community's primary language, in the field — not in a classroom.

Day 1: Ecological observation skills

- What to look for on a transect walk: how to observe systematically rather than casually
- Species identification for the community's priority species list — using drawings, photographs, and direct field observation of known specimens
- Photographic documentation: how to take clear photographs of species, habitat condition, and threats
- Recording: filling in the simple monitoring form during a practice walk

Day 2: Documentation and rights linkage

- Transect mapping: marking monitoring routes on a sketch map and GPS coordinates if available

- Connecting monitoring to CFR rights: why documentation matters legally and how records are stored
- Practice run: a full practice transect walk with documentation
- Review: going through the completed forms together, identifying gaps and improvements

Who should be trained:

- The CFMRC secretary is the primary documentation manager
- 3–5 community members with strong ecological knowledge as core monitors
- 2–3 younger community members (including women) as secondary monitors — building next-generation capacity
- Total: 8–10 trained monitors is the right number for a 100–500 hectare CFR area

Component 4: Technology and data management

The right technology for remote tribal contexts: A shared community smartphone with good camera and offline mapping capability is sufficient for most monitoring purposes. Apps like iNaturalist (for species identification using AI-assisted photo recognition), Kobo Collect (for offline form-based data collection), and Maps.me (for offline mapping) work without internet connectivity and sync when connectivity is available.

Paper records as primary, digital as backup: In communities without reliable internet or consistent digital literacy, paper monitoring registers are the primary record. The gram sabha register holds monitoring forms, species inventories, and patrol logs. A photographic record on a smartphone is the secondary layer. Digital uploading when connectivity is available (at block headquarters, or via a community member with smartphone and data in the nearest town) provides off-site backup.

ATREE's citizen science model for the Eastern Ghats specifically uses a combination of community monitoring forms, GPS point data collected by community

volunteers, and satellite imagery cross-validation. The community data fills in what the satellite cannot see; the satellite provides context for what the community data is telling. An NGO that facilitates community monitoring can arrange periodic data-sharing with ATREE or comparable research organisations, producing both the scientific benefit and the institutional legitimacy of having the community's data taken seriously by researchers.

Component 5: Using the data

Monitoring data that is collected and filed but never used produces disillusionment and programme collapse. The community needs to see the data being used — for management decisions, for legal defence, for advocacy.

Management use: CFMRC meetings include a standing agenda item — what did the monitoring show this season? What does it mean for management decisions? If mahua flowering is declining in the northern patches, what is the cause and what can the community do? The monitoring data drives adaptive management rather than sitting in a file.

Legal use: When a mining project, a road alignment, or a forest department action threatens the CFR area, the monitoring records are produced as evidence of the community's active management. The species inventory showing that the area has documented wildlife presence strengthens the case against diversion. The patrol logs demonstrating years of community protection demonstrate the seriousness of the community's governance.

Advocacy use: Aggregated data from community monitoring across multiple villages — showing, for example, a pattern of wildlife decline correlated with road construction in a corridor — can support district-level or state-level advocacy. NGOs that facilitate monitoring across multiple CFR gram sabhas and help communities pool and share their data produce an evidence base that no single community could create alone.

The iNaturalist Platform: A Specific Tool

iNaturalist is a free global citizen science platform that allows users to record species observations with photographs, which are then verified by the global iNaturalist community and contributed to scientific biodiversity databases. The India node — iNaturalist India — is active and has significant data contribution from forest-adjacent communities.

For Odisha's tribal forest communities, iNaturalist offers:

- Free, offline-capable observation recording (syncs when internet is available)
- AI-assisted species identification from photographs (useful for species that community members can observe but cannot formally name in scientific taxonomy)
- Contribution of community data to global biodiversity databases — which creates scientific legitimacy and potential engagement with researchers
- A digital record with timestamps and GPS coordinates that cannot be disputed as fabricated

The limitation: iNaturalist requires a smartphone with camera and occasional internet connectivity for upload. In communities without these, paper-based observation records remain the primary tool.

Connecting to Formal Research Institutions

ATREE (Ashoka Trust for Research in Ecology and the Environment) has an active presence in the Eastern Ghats research context and is receptive to data-sharing partnerships with community monitoring programmes that produce systematic, comparable data. NGOs facilitating community monitoring in Odisha's Eastern Ghats forest communities should contact ATREE's Bangalore office to explore whether community-generated data can be incorporated into their research programmes — which both validates the data and provides communities with institutional recognition

of their monitoring work.

SCSTRTI (Scheduled Castes and Scheduled Tribes Research and Training Institute, Bhubaneswar) has a mandate for research on Odisha's tribal communities, including their relationship with forest ecosystems. Community biodiversity monitoring data is directly relevant to SCSTRTI's research agenda.

Bharat Tribal Health Observatory (ICMR-RMRC Bhubaneswar) — while primarily a health research institution — has expressed interest in traditional ecological knowledge as part of its broader community health and environmental mandate. There may be opportunities for cross-sector data sharing.

Related Knowledge Commons content: Environment & Climate Sector Primer (Sector 07) · Practice Note: Community Forest Rights — From Title to Conservation · Practice Note: Oral Tradition Documentation — for traditional ecological knowledge recording

Evidence Grade: B — Multi-study. This Practice Note draws on the Communications Earth & Environment participatory monitoring study (2023), the Nature Sustainability GBF monitoring study (2024), ATREE's Eastern Ghats community perception research (PMC 2019), the Greener Journals community-based conservation review (2024), and the PMC locally-based monitoring conceptual framework (2021). Last reviewed: April 2026.

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